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Test Anxiety and Post Processing Interference, II

Sigmund Tobias and Joanne Sacks

City College, City University of New York

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This experiment was performed to determine whether test anxiety interferes in the retrieval of prior learnings from long-term memory and to investigate the degree to which anxiety affected post processing interference. Thirty students were administered Sarason's Text Anxiety Scale and four subtests of Weinstein's Learning and Study Skills Inventory (LASSI). Students were asked to memorize two 18-word lists, each consisting of three different categories, to a criterion of one perfect recall. Students were randomly assigned to one of three conditions: (1) acquisition stress ego involving instruction administered prior to the beginning of the task, (2) ego involving instructions after acquisition, or (3) no ego involving instruction of any kind. It is conceivable that study skills, like test anxiety, affect performance mainly in the presence of effective stress.

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Test Anxiety and Post Processing Interference, II

Sigmund Tobias and Joanne Sacks
City College, City University of New York

The purpose of this experiment was to determine whether test anxiety interfered in the retrieval of prior learning from long-term memory. A model for research on anxiety in instructionally relevant situations (Tobias, 1977, 1979) indicated that anxiety as an affective variable could have only an indirect effect on performance by impacting on the cognitive processes controlling learning. The model hypothesized that anxiety could affect learning at three points: 1) Preprocessing, that is, when instruction is presented prior to its encoding by students, 2) during processing of the material, or 3) post processing, that is, when prior learning was retrieved during testing. The aim of this study was to investigate the degree to which anxiety affected post processing interference.

There is a good deal of evidence indicating that anxious students receive lower scores in evaluative situations than their lower anxiety counterparts (Sarason, 1980; Sieber, O'Neil, & Tobias, 1977). One interpretation of this effect has been that the attention of test anxious students is divided between task demands and a variety of negative self-cognitions. Those lower in anxiety, on the other hand, devote a greater percentage of their attention to the task demands,

and less attention to negative self-preoccupations hence improving their performance (Sarason, 1972; Wine, 1971). This interpretation assumes that test anxiety interferes most prominently with the retrieval of prior learning; i.e., that interference is principally at the post processing stage.

Another interpretation of the lower performance by test anxious students is that they learn the material less thoroughly to begin with due to defective study skills; this deficit is only seen later when students are evaluated. Support for this interpretation is had from the negative relationships between study skills tests and measures of anxiety, and from related findings (Culler & Hollahan, 1980; Kirkland & Hollandsworth, 1979; Desiderato & Koskinen, 1969; Mitchell & Ng, 1972; Wittmaier, 1972). A second purpose of this experiment was to study the relative contributions of study skills at acquisition, and at retrieval.

It has been noted (Tobias, 1984a) that interference by anxiety in the retrieval of learning requires differentiation between mastery of the material at acquisition, and again at retrieval. Unfortunately, there are only a few studies which examined the acquisition and retrieval distinction with respect to test anxiety. Wendell and Tobias (1983) studied student learning from six televised video modules. Students received a pretest prior to each module and a posttest immediately after its completion. A delayed posttest, utilizing all the items from the posttests administered after each module, was given approximately 3 1/2 weeks later. Two retrieval indices were calculated: 1) A score based on items passed on pretest,

passed on immediate posttest, but failed on delayed posttest 3 1/2 weeks later. The correlation between test anxiety and this index was .22, significant at the .05 level. 2) An index composed of items failed on pretest, passed on immediate posttest and failed on delayed posttest. This score was not significantly related to test anxiety.

Another study (Tobias, 1984a) used a list learning paradigm to study this problem. Students learned a list of 18 words, composed of six categories, to a criterion of perfect recall. Next, another 18 word list, composed of three similar categories, was administered three times. Students then were administered some research instruments and, finally were asked to recall both lists. Worry, a component of test anxiety (Morris, Davis & Hutchings, 1981), significantly affected the retrieval of List 1 words, but study skills did not. A set of anxiety scales composed of Sarason's Test Anxiety Scale (1980) and the Worry and Emotionality measures (Morris, et al, 1981), had a significant effect on the total number of List 2 words recalled, as did the set of study skills scales. A more precise test of retrieval for List 2 words, however, used a dependent variable composed of those words mastered on acquisition yet failed on recall. The latter index was significantly affected by Worry and by the total group of anxiety scales; a set of study skills scales also had a marginally significant effect (p =.06) on this variable.

In the list learning study neither anxiety nor study skills were significantly related to acquisition. It was reasoned that the absence of an acquisition effect may have been attributable to the administration of stress instructions, relating task performance to

school learning, prior to retrieval, but not at acquisition. Prior research (Sarason, 1980) has indicated that anxiety effects tend to occur mainly in the presence of such stress instructions. The final purpose of this experiment was to test this interpretation.

Method

Students were randomly assigned to three groups to study two lists of words. Test anxiety, and study skills scales were also administered to students.

Procedures

All the students participating in this study had volunteered for a preceding experiment (Tobias, 1984b). For that study students were administered Sarason's (1972) Test Anxiety Scale, a Worry-Emotionality (Morris, Davis, & Hutchings, 1981) scale and four sub-tests of Weinstein's (1983) Learning and Study Skills Inventory (LASSI). The remainder of the procedures for this study were administered after students completed all the requirements of the preceding experiment.

Students were asked to memorize two 18 word lists, each consisting of three different categories to a criterion of one perfect recall. The first list consisted of the following categories and words: A fruit category was composed of lime, cherry, grape, apricot, peach and mango. A clothing category consisted of slipper, boot, scarf, vest, shorts and jacket. Finally, an animal category consisted of kitten, donkey, leopard, fox, deer and badger. The mean frequency of appearance of the words in this list was 20.89 per 1,000 (Thorndike & Lorge, 1944). The second list consisted of the following categories and words: A vegetable category consisted of

onion, cabbage, mushroom, pea, celery and tomato. A parts of the body category consisted of hip, tooth, wrist, jaw, ankle and chin. A birds category consisted of parrot, swan, owl, dove, turkey and lark. The mean frequency of appearance of this list was 20-33 per 1,000.

After students completed the first list, the Worry-Emotionality Scale was re-administered on computer with instructions for subjects to respond the way they felt while memorizing the words.

Word lists were administered on Apple II plus microcomputers. Students typed their responses on the computer, after the list had been exposed for 30 seconds. Minor variations in spelling were accepted for each of the words. After the students completed a trial, checking the accuracy of the list required approximately 12 seconds, following which the list was presented again if criterion had not been attained. Word order was randomized by the machine for each trial. It became clear that some students were experiencing difficulty in using the computers to type their responses. A practice program was prepared in which subjects were required to recall three words in order to familiarize them with the computer procedures.

After subjects recalled both lists, some subtests of the LASSI were administered on computer, as was another Worry-Emotionality Scale with instructions to respond the way students felt while studying the words. All students were then asked to recall as many of the words as they could from List 1, and then from List 2. Finally, another Worry-Emotionality Scale was administered with instructions to respond the way students felt while recalling the words.

Students were randomly assigned to one of three conditions. In

the first group, acquisition stress was induced through ego involving instructions administered prior to the beginning of the task. The instructions were presented on a computer and read by a research assistant stressing that performance on this task was related to students' performance in school. A second group, received these ego involving instructions after acquisition, and before delayed recall of the words was requested. The control group, received no ego involving instructions.

Subjects

Students (N= 114, 48 female, 66 male) who participated in this experiment were recruited from the student population of the City College of New York, and were paid $12 for their participation in the present and the preceding (Tobias, 1984b) experiment. A total of 30 students had been run prior to the preparation of the practice trial program.

Results and Discussion

An initial regression analyses was computed to determine whether students receiving a practice trial prior to list learning differed from the preceding group not receiving a practice trial. This analysis indicated that there were no such differences, so the data for all subjects were, therefore, pooled. The means and standard deviations for all variables are presented in Table 1. Tables 2 and 3 present the multivariate and univariate regresssion

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Insert Table 1, 2 and 3 here.

Table 1 Means and Standard Deviations for Anxiety and Study Skills Study, by Groups.

Variables	No Stress		Acquisition Stress		Retrieval Stress	
	M	SD	M	SD	M	SD
List 1 DATA						
Acquisition						
No. of Trials	10.16	4.40	9.35	3.26	9.55	4.65
Mean correct/trial	12.56	2.17	12.69	1.96	12.73	1.77
Total time	1501.83	774.73	1523.48	752.89	1373.17	712.71
Mean rep. ratio[1]	.67	.17	.64	.17	.63	.17
Delayed Recall						
No. Correct	14.36	5.10	14.13	5.40	9.95	7.92
Time	209.70	107.32	187.70	86.12	167.04	108.97
Repetition Ratio	.72	.32	.70	.32	.51	.44
List 2 DATA						
Acquisition						
No. of Trials	7.10	3.57	7.38	4.25	7.12	4.03
Mean correct/trial	13.03	2.41	13.15	2.53	12.79	2.17
Total time	949.04	610.87	968.00	731.85	898.53	682.25
Mean rep. ratio[1]	.68	.21	.68	.25	.66	.26
Delayed Recall						
No. Correct	16.05	3.88	16.30	3.44	13.58	6.35
Time	176.43	85.74	175.40	69.75	171.38	82.77
Repetition Ratio	.77	.27	.71	.26	.68	.37

Anxiety Data

TAS	17.69	7.92	17.41	6.41	18.79	6.52
Worry-Acquisition	8.97	4.40	8.28	4.31	8.77	4.46
Emotion.-Acquisition[2]	8.30	3.33	8.67	3.69	9.09	4.24
Worry-Delayed Recall	7.39	3.07	7.02	2.96	8.09	3.65
Emotion.-Delayed Recall[2]	7.47	4.11	8.36	4.08	8.42	4.45

Study Skills Data (LASSI)

Motivation	29.78	7.31	31.50	11.14	29.76	7.49
Self-Test	15.57	4.16	18.34	9.78	16.17	3.38
Scheduling	16.08	4.00	14.82	4.81	15.57	3.97
Attitude	7.28	2.82	8.26	7.60	7.36	2.83
Information Processing	57.44	10.31	60.28	11.90	59.18	11.95

1. Repetition Ratio
2. Emotionality

Table 2 Multivariate and Univariate Regression Analyses for Acquisition Data

	List 1					List 2			
	Wilks[a]	No. Trials	Mean Correct	Total Time	Mean Cluster Score	No. Trials	Mean Correct	Mean Cluster Score	Total Time
Condition (C)	<1	<1	<1	<1	<1	<1	<1	<1	1.05
Anxiety (A)	<1	<1	<1	<1	<1	2.08	2.40	<1	<1
Study Skills(SS)	1.11	<1	<1	<1	2.04	<1	2.26	<1	<1
C X A	<1	<1	<1	1.00	<1	<1	1.68	<1	<1
C X SS	1.27	<1	<1	<1	1.45	3.07	3.36[a]	<1	1.74
A X SS	<1	<1	<1	<1	<1	<1	<1	<1	<1
C X A X SS	<1	<1	<1	<1	<1	<1	<1	<1	<1

a) Approximate F for Wilk's Lambda.

[a] $p \leq .05$

Table 3 Multivariate and Univariate Regression Analyses Results for Retrieval Data

	Wilks[a]	List 1 No. Correct	List 1 Time	List 1 Mean Cluster Score	List 2 No. Correct	List 2 Time	List 2 Mean Cluster Score
Condition (C)	2.43	7.96*	<1	4.80*	4.85*	<1	1.28
Anxiety (A)	<1	1.40	<1	<1	<1	<1	<1
Study Skills(SS)	<1	<1	<1	<1	<1	<1	<1
C X A	1.03	<1	2.75	<1	<1	1.20	<1
C X SS	<1	1.18	<1	<1	<1	1.60	<1
A X SS	<1	<1	<1	<1	<1	<1	<1
C X A X SS	<1	1.3	3.61*	<1	<1	1.05	<1

a) Approximate F for Wilk's Lambda.

* $p \leq .05$.

analyses for both acquisition and retrieval data respectively. The results indicated that there were no overall multivariate effects for either data set. Table 2 reveals a significant interaction between treatment and study skills for the mean number of words correctly recalled for List two, and a triple interaction between treatment, anxiety and study skills on the time spent retrieving List 1. Table 3 presents a significant main effect for treatment and and the number of words recalled correctly at delayed recall for List 1, List 2 and for a clustering index score for on List 1. In view of the fact that the multivariate test was not significant, the univariate results can only be interpreted with caution.

The results failed to support the major expectations of this experiment. There were no overall multivariate effects for group, test anxiety or for study skills. A univariate effect was found for the following delayed recall data: number correct on List 1, List 2 and the clustering index for List 1. These results may be explained by the fact that the delayed recall condition was probably intrinsically most stressful since students knew that, unlike acquisition, they would not have another opportunity to master missed words. Apparently, these factors combined with the instructions were sufficient to reduce recall for the retrieval stress group.

The findings of no significant effects attributable to study skills or test anxiety may well be a function of the circumstances under which this experiment was conducted. As indicated before, student volunteers had already participated in another study. That research required a total of two sessions, in the first of which

students received Sarason's (1980) Test Anxiety Scale, a preliminary Worry-Emotionality instrument, some of Weinstein's study skills scales, in addition to a variety of other instruments. In the second session of the preceding experiment students learned some material on a computer, and received another Worry-Emotionality Scale. Then, by the time students reported for the present experiment they had substantial opportunities to become both experiment- and test-wise.

The frequent prior administrations of the Worry-Emotionality Scale may have induced subjects to respond in a relatively routine manner rather than reflecting their true feelings. Support for this interpretation is had from the fact that there were no differences in Worry-Emotionality Scores between the various groups either at acquisition or at retrieval. If the instruction had in fact succeeded in arousing differential levels of stress among students, one would have expected that the acquisition stress group should have had higher scores on the Worry-Emotionality measure administered at acquisition, and the retrieval stress group should have had higher worry scores at retrieval. The fact that these scores did not differ from those of the group lent support to the fact that the instructions did not succeed in arousing differential stress. Failure of the anxiety indices, then, to affect acquisition or retrieval is understandable since research (Sarason, 1980) has indicated that anxiety effects do not appear in the absence of evaluative stress.

There is considerably less research regarding the conditions under which study skills affect performance. In a preceding investigation (Tobias, 1984a) study skills affected retrival in the

presence of instruction suggesting that the task was related to school performance. It seems conceivable that study skills, like test anxiety affect performance mainly in the presence of effective stress. It may be useful to investigate this possibility in future research.

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